2.0   CAPACITY CRITERIA

2.1   Wastewater Treatment Plants

The Texas Commission on Environmental Quality (TCEQ) recommends a minimum of 100 gallons per capita per day (gpcd) for municipal base flow. The 2011 master plan determined that the existing loading for the City of Fort Worth and its wholesale customers is 97 gpcd. The 2011 master plan recommends using 110 gpcd and an additional 10 gpcd to account for groundwater infiltration (GWI) to raise the total per capita for future growth to 120 gpcd. The 2011 master plan determined that the current usage per employee per day for the City of Fort Worth is 37 gallons per employee per day. Additionally, the master plan recommends using 40 gped for future commercial growth.

The following formula was then used for the calculation of average day flow:

$$Q_{avg} = [(2010\ \text{Residential} \times 2010\ \text{gpcd}) + (2010\ \text{Non-residential} \times 2010\ \text{gped})] +$$
$$[(\text{Population Growth} \times \text{Growth gpcd}) + (\text{Employment Growth} \times \text{Growth gped})]$$

Where:

Q_{avg}	= Average day wastewater flow
2010 Residential Flow	= 993,278 (from 2011 *Wastewater System Master Plan*)
2010 Non-res. Flow	= 522,487 (from 2011 *Wastewater System Master Plan*)
2010 gpcd	= 97 gpcd (from 2011 *Wastewater System Master Plan*)
2010 gped	= 37 gped (from 2011 *Wastewater System Master Plan*)
Population Growth	= Population Growth from 2010 to 2013/2023 for Impact Fees
Growth gpcd	= 120 gpcd (from 2011 *Wastewater System Master Plan*)
Employment Growth	= Employment Growth from 2010 to 2013/2023 for Impact Fees
Growth gped	= 40 gped (from 2011 Wastewater System Master Plan)

The following is a calculation of the annual average day wastewater flows. The population and employment growth projections were taken from the *Exhibit B: Land Use Assumptions- Wastewater Facilities*. The population and employment projections for the TRA Denton Creek Regional Wastewater System and TRA Central Regional Wastewater System were subtracted from the total wastewater service area population and employment projections as well as proposed Capital Improvement Projects (CIP).

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<u>2013 Annual Average Flow</u>

2010 Residential Flow = 993,278 x 97 gpcd = 96.3 mgd
2010 Non-residential Flow = 522,487 x 37 gpcd = 19.3 mgd

Growth in Residential Flow = (1,026,085 – 993,278) x 120 gpcd = 3.9 mgd
Growth in Non-residential Flow= (575,222 – 522,487) x 40 gpcd = 2.1 mgd

Q_{avg} = [(96.3 mgd) + (19.3 mgd)] + [(3.9 mgd) + (2.1 mgd)]
Q_{avg} = 121.6 mgd

<u>2023 Annual Average Flow</u>

2010 Residential Flow = 993,278 x 97 gpcd = 96.3 mgd
2010 Non-residential Flow = 522,487 x 37 gpcd = 19.3 mgd

Growth in Residential Flow = (1,293,720 – 993,278) x 120 gpcd = 36.0 mgd
Growth in Non-residential Flow= (689,908 – 522,487) x 40 gpcd = 6.7 mgd

Q_{avg} = [(96.3 mgd) + (19.3 mgd)] + [(36.0 mgd) + (6.7 mgd)]
Q_{avg} = 158.3 mgd

The net increase in annual average flow for the study period is:

Increase in Annual Average Flow = 2023 Annual Average Flow – 2013 Annual Average Flow

Increase in Annual Average Flow = 158.3 mgd – 121.6 mgd
Increase in Annual Average Flow = 36.7 mgd

The 2011 *Wastewater System Master Plan* did not use a straight average flow to peak flow peaking factor because the City utilized an extended period simulation model to determine the projected peak flows. The model used the RTK method which calculates a different peaking factor for each scenario dependent on amount of rainfall, peaking time, and recession time. From the 2011 *Wastewater System Master Plan* the historical annual average flow to peak hour flow ratio is 2.87 and is used to calculate the 2013 peak flow.

The following formula was used for the calculation of peak flow:

$$Q_{Peak} = Q_{avg} \text{ x PF}$$

Where: Q_{avg} = Average day wastewater flow
PF   = Average day wastewater flow to peak flow peaking factor

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2013 Peak Flow

Q_{avg} = 121.6 mgd
PF   = 2.87

Q_{peak} = 121.6 mgd x 2.87
Q_{peak} = 349 mgd

The peaking factor for the calculation of 2023 peak flow is reduced from 2.87 to 2.67 to provide a credit for reducing rain dependent inflow and infiltration with near term CIP improvements made to the wastewater collection system. The 2023 peak flow calculation is:

2023 Peak Flow

Q_{avg} = 158.3 mgd
PF   = 2.67

Q_{peak} = 158.3 mgd x 2.67
Q_{peak} = 423 mgd

2.2   Lift Stations and Force Mains

The City currently has 30 lift stations located throughout the wastewater service area to convey flow against gravity and ultimately to the Village Creek WRF. A table showing existing lift station capacities can be found in **Appendix A.** Lift station deficiencies were calculated using information from the 2011 *Wastewater System Master Plan* and near term planned improvements. The data below shows the lift station deficiencies for each time period:

	2013	2023
Population*	1,026,085	1,293,720
Employment*	575,222	689,908
Lift Station Deficiency	36.3 mgd	65.4 mgd

*Excludes the TRA Denton Creek and TRA Central population/employment estimates

The net increase in lift station deficiencies is:

Increase in Lift Station Deficiencies = 65.4 mgd – 36.3 mgd = 29.1 mgd